# THERMOTICS CIRCULATION SUB

Circulation sub is designed to allow diversion of mud flow into annulus whenever required and combat common drilling problems, such as lost circulation and limited circulating rates. Sub operation control does not require dedicated trips.

It is always recommended to include the circulation sub into BHA in following cases:

**» Acid, chemical and bridging agent treatments, which can be dangerous for below located BHA components.**
**» Reaming during loss of circulation, full loss of circulation.**
**» Wellbore cleanout required for acceleration of the flow in annular space by increase of mud flow.**

The sub has several configurations, which differ by number of operation cycles and activation/deactivation pressures without need of pulling out of hole.

## Features & Benefits

►Significantly increases economic efficiency by reducing time per operation trips.

►Restore circulation, bottom hole chemical treatments are possible without BHA additional tripping.

►Up to 10 activations at one BHA trip (4/5 activations is standard).

►Different options for deactivation pressures (2100psi, 3000psi, 4500psi).

►Simple visual control of pressure drop.

►No limitations for LCM type of materials to fight loss of circulation.

►In case of circulation stop, the sub blocks the ports automatically to prevent cross flow of mud between annular space and the drilling string.

►A “dump sub” function can be activated after pulling out of hole.

►Sub has been successfully run in the harshest environments including CO2 and H2S.


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| Specifications (Imperial) | | | |
|---|---|---|---|
| | **CS475** | **CS675** | **CS825** |
| Outer diameter d, (in) | 4 ¾ | 6 ¾ | 8 ¼ |
| The length of the Sub L, (in) | 83.9 | 102.2 | 115.9 |
| Weight (lb) | 276 | 772 | 1124 |
| Quantity of ports, piece | 2 | 2 | 2 |
| Activation ball OD (in) | 1.5 | 2 | 2.25 |
| Blocking ball OD (in) | 1.13 | 1.13 | 1.37 |
| Deactivation ball OD (in) | 1.31 | 1.38 | 1.73 |
| Port size (in) | 1.02 | 1.12 | 1.36 |
| Connecting threads | NC 38 | NC 50 | 6 5/8 Reg |
| **Operating Parameters** | | | |
| Maximum flow rate (gpm) | 396 | 713 | 1014 |
| Pressure drop with direct circulation (with empty basket) (psi) | 61 | 145 | 72.5 |
| Pressure drop (circulation through side ports) (psi) | 54 | 217.6 | 174 |
| Make-Up torque (ft·lbs) | 8,482 – 10,695 | 29,500 – 33,900 | 56,800 – 64,200 |
| Number of cycles (std / ext) | 5/10 | 5/10 | 5/10 |
| Activation pressure (psi) | 87 | 116 | 58 |
| Deactivation pressure (psi) | 2100 | 2103 | 2103 |
| Blocking ball push-through pressure (psi) | 1088 | 1088 | 1088 |
| TFA (non-activated tool) (in.sq.) | 1.7 | 2.97 | 3.78 |
| Flow area when tool is activated (in.sq.) | 0.99 | 0.99 | 1.45 |
| Maximum tensile load (lb) | 737,250 | 1,344,000 | 2,136,000 |
| Torsional strength main body (ft·lb) | 18,880 | 199,141 | 346,653 |

| Specifications (Metric) | | | |
|---|---|---|---|
| | **CS475** | **CS675** | **CS825** |
| Outer diameter d, (mm) | 120 | 172 | 210 |
| The length of the Sub L, (mm) | 2132 | 2596 | 2945 |
| Weight (kg) | 125 | 350 | 510 |
| Quantity of ports, piece | 2 | 2 | 2 |
| Activation ball OD (mm) | 38.1 | 50.8 | 57.1 |
| Blocking ball OD (mm) | 28.6 | 28.6 | 34.9 |
| Deactivation ball OD (mm) | 33.33 | 34.92 | 44.45 |
| Port size (mm) | 28.5 | 28.5 | 34.5 |
| Connecting threads | NC 38 | NC 50 | 6 5/8 Reg |
| **Operating Parameters** | | | |
| Maximum flow rate (l/s) | 25 | 45 | 64 |
| Pressure drop with direct circulation (with empty basket) (mpa) | 0.42 | 1.0 | 0.5 |
| Pressure drop (circulation through side ports) (mpa) | 0.37 | 1.5 | 1.2 |
| Make-Up torque (N·m) | 11,500 – 14,500 | 40,000 – 46,000 | 77,000 – 87,000 |
| Number of cycles (std / ext) | 5/10 | 5/10 | 5/10 |
| Activation pressure (mpa) | 0.4 | 0.8 | 0.4 |
| Deactivation pressure (mpa) | 14.5 | 14.5 | 14.5 |
| Blocking ball push-through pressure (mpa) | 7.5 | 7.5 | 7.5 |
| TFA (non-activated tool) (mm.sq.) | 1095 | 1917 | 2440 |
| Flow area when tool is activated (mm.sq.) | 638 | 638 | 935 |
| Maximum tensile load (kN) | 2500 | 5980 | 9500 |
| Torsional strength main body (N·m) | 80,000 | 270,000 | 470,000 |